IN THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently amended) A lithographic projection apparatus for imaging a pattern onto a substrate that is at least partially covered by a layer of radiation-sensitive material, the apparatus comprising:

a radiation system configured to provide a beam of radiation;

a support configured to support a patterning structure, the patterning structure configured to produce a desired pattern in the beam of radiation;

a substrate table configured to hold a substrate;

a projection system configured to project the patterned beam of radiation onto a target portion of the substrate; and

a radiation absorber comprising a gas supply configured to supply an absorbent gas at a controlled concentration to at least one enclosure traversed by the beam of radiation, the absorbent gas serving to absorb radiation energy delivered by the beam of radiation to the substrate during exposure of the radiation-sensitive material to the patterned beam of radiation, wherein the absorbent gas comprises one of xenon (Xe); water (H_2O); hydrocarbons; and compounds and mixtures thereof.

2. (Original) An apparatus according to claim 1, wherein the radiation absorber is configured and arranged to adjust at least one of:

radiation power emitted by a radiation source configured to supply radiation to the radiation system;

the uniformity of energy of the beam of radiation perpendicular to an optical axis of the apparatus;

radiation energy of pulses of radiation emitted by the radiation source;

duration of an exposure of a target portion; and

angular distribution of the radiation energy delivered by the beam of radiation.

3. (Original) An apparatus according to claim 1, wherein the radiation absorber is located proximate one of: a pupil plane of the projection system; a plane of the patterning

structure; a plane of the substrate; a conjugate plane of the pupil plane; a conjugate plane of the patterning structure plane; and a conjugate plane of the substrate plane.

4. (Previously presented) An apparatus according to claim 1, wherein the enclosure is substantially transparent to the beam of radiation in a direction parallel to its direction of propagation.

5. (Original) An apparatus according to claim 4, wherein the enclosure further comprises a first aperture configured to allow the beam of radiation to enter the enclosure, and a second aperture configured to allow the beam of radiation to exit the enclosure.

6. (Currently amended) An apparatus according to claim 1, wherein the beam of radiation has a focal point and the absorption of the projection beam by the absorbent gas is ~~substantially~~ located at the focal point.

7. (Original) An apparatus according to claim 1, wherein an optical path of the beam of radiation is substantially evacuated.

8. (Original) An apparatus according to claim 1, wherein the radiation system is configured to provide radiation comprising wavelengths in the range of 5 nm to 20 nm.

9. (Previously presented) An apparatus according to claim 1, wherein the radiation absorber further comprises a gas extractor configured to extract the absorbent gas from the enclosure.

10. (Previously presented) An apparatus according to claim 1, wherein a speed at which the absorbent gas enters the enclosure is approximately greater than the speed of sound.

11. (Previously presented) An apparatus according to claim 1, wherein a speed at which the absorbent gas enters the enclosure is approximately ten times the speed of sound.

12. (Canceled)

13. (Original) An apparatus according to claim 1, wherein the gas supply is configured to supply the absorbent gas mixed at a controlled concentration with a purge gas.

14. (Original) An apparatus according to claim 1, wherein the radiation system is configured to provide radiation comprising wavelengths less than 365 nm.

15. (Original) An apparatus according to claim 1, wherein the radiation absorber is configured to have a gas concentration in a path of the beam of radiation that is controllably non-uniform in a plane perpendicular to an optical axis of at least one of the radiation system and the projection system.

16. (Original) An apparatus according to claim 15, wherein the radiation absorber is arranged to have a gas concentration that is substantially symmetric about the optical axis.

17. (Original) An apparatus according to claim 1, wherein the at least one volume comprises one of: a pupil plane of the projection system and a conjugate plane of the pupil plane.

18. (Original) An apparatus according to claim 1, wherein the radiation absorber is arranged to have a gas concentration that is controllably variable in a direction perpendicular to a scanning direction in which the substrate table is moved during a scanning exposure.

19. (Original) An apparatus according to claim 1, wherein the radiation absorber is located proximate one of: a plane of the patterning structure; a plane of the substrate; a conjugate plane of the patterning structure plane; and a conjugate plane of the substrate plane.

20. (Original) An apparatus according to claim 1, wherein a mean free path of the absorbent gas within the at least one volume is in the range of 1 mm-10 cm.

21. (Original) An apparatus according to claim 1, wherein the radiation absorber further comprises a controller configured to control at least one physical property of the absorbent gas.

22. (Original) An apparatus according to claim 21, wherein the physical property of the absorbent gas is one of: absorbent gas pressure; path length of the beam of radiation through the absorbent gas; and composition of the absorbent gas.

23. (Original) An apparatus according to claim 1, wherein the radiation absorber comprises a plurality of gas supplies configured to supply a plurality of different absorbent gasses at controlled concentrations to the at least one volume.

24. (Currently amended) A device manufacturing method, comprising:

projecting a patterned beam of radiation onto a target portion of a layer of radiation-sensitive material at least partially covering a substrate;

controlling at least one of an energy of the patterned beam and a duration of exposure of the radiation-sensitive material to the patterned beam, such that a desired dose of radiation is delivered to the substrate; and

supplying an absorbent gas according to a concentration profile to an enclosure traversed by the beam of radiation to effect a desired attenuation of the patterned beam, the absorbent gas absorbing a wavelength of the radiation, wherein the absorbent gas comprises one of xenon (Xe); water (H_2O); hydrocarbons; and compounds and mixtures thereof.

25. (Currently amended) A device manufacturing method, comprising:

projecting a patterned beam of radiation onto a target portion of a layer of radiation-sensitive material at least partially covering a substrate;

controlling the energy profile of the patterned beam of radiation, such that a desired radiation uniformity is delivered to the substrate during an exposure; and

supplying an absorbent gas according to a concentration profile to an enclosure traversed by the beam of radiation to effect a desired non-uniform attenuation of the patterned beam, the absorbent gas absorbing a wavelength of the radiation, wherein the absorbent gas comprises one of xenon (Xe); water (H_2O); hydrocarbons; and compounds and mixtures thereof.

26. (Previously presented) A lithographic projection apparatus for imaging a pattern onto a substrate that is at least partially covered by a layer of radiation-sensitive material, the apparatus comprising:

a radiation system to provide a beam of radiation;

a support configured to support a patterning structure, the patterning structure configured to produce a desired pattern in the beam of radiation;

a substrate table configured to hold a substrate;

a projection system configured to project the patterned beam of radiation onto a target portion of the substrate; and

a radiation-energy detector configured to determine the energy of the beam of radiation, the beam of radiation passing at least partly through a region of interactive gas, the detector comprising a sensor, the sensor, in operation, providing an output signal that is proportional to an amount of interaction of the beam of radiation with the region of gas.

27. (Original) An apparatus according to claim 26, wherein the radiation-energy detector is located proximate one of: a pupil plane of the projection system; a plane of the patterning structure; a plane of the substrate; a conjugate plane of the pupil plane; a conjugate plane of the patterning structure plane; and a conjugate plane of the substrate plane.

28. (Previously presented) An apparatus according to claim 26, wherein the radiation-energy detector further comprises a gas supply configured to supply the interactive gas at a controlled concentration to an enclosure traversed by the beam of radiation.

29. (Original) An apparatus according to claim 28, wherein the gas supply is configured to supply the interactive gas mixed at a controlled concentration with a purge gas.

30. (Original) An apparatus according to claim 26, wherein the radiation system is configured to provide radiation comprising wavelengths less than 365 nm.

31. (Original) An apparatus according to claim 26, wherein the radiation radiation-energy detector comprises an enclosure at least partially surrounding the region of interactive gas and being substantially transparent to the radiation of the beam of radiation in a direction parallel to its direction of propagation.

32. (Original) An apparatus according to claim 31, wherein the enclosure further comprises a first aperture configured to allow the beam of radiation to enter the enclosure, and a second aperture configured to allow the projection beam to exit the enclosure.

33. (Original) An apparatus according to claim 26, wherein the beam of radiation has a focal point and the interaction of the beam of radiation with the region of interactive gas is substantially located at the focal point.

34. (Original) An apparatus according to claim 26, wherein the optical path of the beam of radiation is substantially evacuated.

35. (Original) An apparatus according to claim 26, wherein the radiation system is configured to provide radiation comprising wavelengths in the range of 5 nm to 20 nm.

36. (Previously presented) An apparatus according to claim 28, wherein the radiation-energy detector further comprises a gas extractor to extract the interactive gas from the enclosure.

37. (Previously presented) An apparatus according to claim 28, wherein a speed at which the interactive gas enters the enclosure is approximately greater than the speed of sound.

38. (Previously presented) An apparatus according to claim 28, wherein a speed at which the interactive gas enters the enclosure is approximately ten times the speed of sound.

39. (Original) An apparatus according to claim 26, wherein the interactive gas comprises one of: oxygen (O); nitrogen (N); helium (He); neon (Ne); argon (Ar); krypton (Kr); xenon (Xe); water ($H2_O$); hydrocarbons; and compounds and mixtures thereof.

40. (Original) An apparatus according to claim 26, wherein the radiation-energy detector is configured to measure the interaction of the beam of radiation with the region of gas at a plurality of points along a plane perpendicular to an optical axis of at least one of the radiation system and the projection system.

41. (Original) Apparatus according to claim 26, wherein the radiation-energy detector is located proximate one of: a pupil plane of the projection system; and a conjugate plane of the pupil plane.

42. (Original) An apparatus according to claim 26, wherein the radiation-energy detector is configured to measure the interaction of the projection beam with the region of gas at a plurality of points in a direction perpendicular to a scanning direction in which the substrate table is moved during a scanning exposure.

43. (Original) An apparatus according to claim 26, wherein the radiation-energy detector is located proximate one of: a plane of the patterning structure; a plane of the substrate; a conjugate plane of the patterning structure plane; and a conjugate plane of the substrate plane.

44. (Original) An apparatus according to claim 26, wherein the sensor is sensitive to a range of electromagnetic radiation including: visible light; ultra violet (UV) light; and infra red (IR) light.

45. (Original) An apparatus according to claim 26, wherein the sensor is sensitive to a type of charged particle including: positive ions; negative ions; and electrons.

46. (Original) An apparatus according to claim 45, wherein the sensor further comprises an electrode configured to be charged at a potential, which is opposite in sign to the type of charged particle.

47. (Original) An apparatus according to claim 26, wherein the radiation-energy detector further comprises a controller receiving the output signal, the controller in response to the output signal being configured to control at least one physical property of the interactive gas.

48. (Original) An apparatus according to claim 47, wherein the physical property of the interactive gas is at least one of: interactive gas pressure; path length of the projection beam through the interactive gas; and composition of the interactive gas.

49. (Previously presented) An apparatus according to claim 26, wherein the radiation-energy detector further comprises a plurality of gas supplies configured to supply a plurality of different interactive gasses at controlled concentrations to an enclosure traversed by the projection beam.

50. (Currently amended) A device manufacturing method, comprising:

projecting a patterned beam of radiation onto a target portion of a layer of radiation-sensitive material at least partially covering a substrate;

controlling at least one of an energy of the patterned beam of radiation and a duration of exposure of the radiation-sensitive material to the patterned beam of radiation, such that a desired dose of radiation is delivered to the substrate during an exposure; and

determining the energy of the radiation by supplying an interactive gas according to a concentration profile to an enclosure traversed by the radiation beam of radiation, measuring the amount of interaction of the beam of radiation with the interactive gas, wherein results of the measurement are used to control the at least one of the energy and the duration, and the absorbent gas comprises one of xenon (Xe); water (H_2O); hydrocarbons; and compounds and mixtures thereof.

51. (Currently amended) A device manufacturing method, comprising:

projecting a patterned beam of radiation onto a target portion of a layer of radiation-sensitive material at least partially covering a substrate;

controlling the energy profile of the patterned beam, such that a desired radiation uniformity is delivered to the substrate during an exposure; and

determining the energy profile of the radiation by supplying an interactive gas to an enclosure traversed by the radiation, measuring the amount of interaction of the radiation with the interactive gas at a plurality of points, wherein results of the measurement are used to control the energy profile of the patterned beam, the absorbent gas comprises one of xenon (Xe); water (H_2O); hydrocarbons; and compounds and mixtures thereof.

52. (Previously presented) A lithographic projection apparatus for imaging a pattern onto a substrate that is at least partially covered by a layer of radiation-sensitive material, the apparatus comprising:

a radiation system configured to provide a beam of radiation;

a support configured to support a patterning structure, the patterning structure configured to produce a desired pattern in the beam of radiation;

a substrate table configured to hold a substrate;

a projection system configured to project the patterned beam of radiation onto a target portion of the substrate;

a radiation absorber comprising a gas supply configured to supply an absorbent gas at a controlled concentration to an enclosure traversed by the beam of radiation, the absorbent gas serving to absorb radiation energy delivered by the beam of radiation to the substrate during exposure of the radiation-sensitive material; and

a radiation-energy sensor proximate to the volume, the sensor, in operation, providing an output signal that is proportional to an amount of interaction of the projection beam with the absorbent gas.

53. (Original) An apparatus according to claim 52, wherein the apparatus further comprises a controller receiving the output signal, the controller in response to the output signal being arranged to control at least one physical property of the absorbent gas.

54. (Previously presented) A device manufacturing method, comprising:

projecting a patterned beam of radiation onto a target portion of a layer of radiation-sensitive material at least partially covering a substrate;

controlling at least one of an energy of the patterned beam and a duration of exposure of the radiation-sensitive material to the patterned beam, such that a desired dose of radiation is delivered to the substrate during an exposure;

supplying an absorbent gas according to a concentration profile to an enclosure traversed by the beam of radiation to effect a desired attenuation of the patterned beam of radiation, the absorbent gas absorbing the radiation wavelength; and

determining the energy of the radiation by measuring an amount of interaction of the radiation with the absorbent gas, wherein results of the measurement are used to control the at least one of the energy and the duration.

55. (Previously presented) A device manufacturing method, comprising:

projecting a patterned beam of radiation onto a target portion of a layer of radiation-sensitive material at least partially covering a substrate;

controlling the energy profile of the patterned beam, such that a desired radiation uniformity is delivered to the substrate during an exposure;

supplying an absorbent gas according to a concentration profile to an enclosure traversed by the beam of radiation to effect a desired non-uniform attenuation of the patterned beam of radiation, the absorbent gas absorbing a wavelength of the radiation; and

determining the energy profile of the radiation by measuring an amount of interaction of the radiation with the absorbent gas at a plurality of points, wherein results of the measurement are used to control the energy profile control of the patterned beam.

56.-61. (Cancelled)

62. (Currently amended) A lithographic projection apparatus for imaging a pattern onto a substrate that is at least partially covered by a layer of radiation-sensitive material, the apparatus comprising:

a radiation system configured to provide a beam of radiation;

a support configured to support a patterning structure, the patterning structure configured to produce a desired pattern in the beam of radiation;

a substrate table configured to hold a substrate;

a projection system configured to project the patterned beam of radiation onto a target portion of the substrate; and

a concentration controlled enclosure of radiation absorbent gas positioned to be traversed by the beam of radiation during exposure of the radiation-sensitive material, wherein the absorbent gas comprises one of xenon (Xe); water (H_2O); hydrocarbons; and compounds and mixtures thereof.